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ORIGINAL ARTICLE

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The wider economic impacts of high-skilled migrants: a survey of the literature for receiving countries

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Abstract

In recent years, the economics of migration literature has shown a substantial growth in papers exploring host country impacts beyond the labour market. Specifically, researchers have begun to shift their attention from labour market and fiscal changes, towards exploring what we might call ‘the wider effects of migration’ on the production and consumption sides of the economy – and the role of high-skilled migrants in these processes. This paper surveys the emerging ‘wider impacts’ literature, including studies from the US, European and other countries. It sets out some simple, non-technical frameworks, discusses the empirical findings and identifies avenues for future research.

JEL codes: G23; G24; J15; J61; L5; L26; M12; M13; O31; O32; R11

Keywords: Immigration; High-skill migrants; Innovation; Entrepreneurship; Investment; Trade; Productivity; Cities

1. Introduction

Skilled migrants are becoming an increasingly important element in global migration flows, especially to more developed nations. Between 2000/1 and 2010/11, for example, OECD countries saw total migrant stocks rise by over 20% to about 100m people. During the same period, the number of tertiary-educated arrivals rose by 70%, over three times faster than the global count, reaching 27.3m in 2010/11 (UN-DESA, OECD 2013). Skilled migrants now comprise nearly 29% all migrants in OECD countries, up from 24% in 2000/1. These shifts seem to be structural; during the past two decades the US and many European countries have experienced not just one-off migration ‘shocks’ but continuous ‘waves’, leading to permanent changes in population and workforce composition (Vertovec 2007).

In turn, this has prompted many researchers to look beyond the short-term impacts of migrants on the labour market (about which we know quite a lot) towards longer term, dynamic effects on the rest of the economy (about which we know much less). In recent years, the economics of migration field has seen a rapid rise in studies exploring what we might call ‘the wider effects of migration’ – and the role of high-skilled migrants in these processes (Chiswick 2005; Huber et al. 2010b; Kerr and Kerr 2011; George et al. 2012; Hanson 2012; Lewis 2012; Nathan 2012a; Kerr 2013).

‘High-skilled migrants’ are usually defined in terms of formal qualifications (education to degree level or beyond). In other cases the focus is on occupations requiring advanced

training (scientists, engineers, researchers and other professionals). Alternatively, human capital is defined in terms of attitudes and soft skills (entrepreneurial drive and aptitude) as well as qualifications.

Nesting high-skilled migration within models of long-term economic development (Lucas 1988; Romer 1990) helps identify some potential 'wider impacts'. For instance, migration may pre-select entrepreneurial individuals who contribute to new business formation, or 'stars' who generate new ideas (Bonacich 1973; Borjas 1987; Zucker and Darby 2007; Honig et al. 2010). For firms, diverse workforces may generate production complementarities, particularly in high-value, knowledge-intensive sectors (Fujita and Weber 2003; Page 2007; Nathan and Lee 2013). Access to co-ethnic networks can assist knowledge diffusion, lower co-ordination costs and thus improve international market access (Kapur and McHale 2005; Saxenian 2006; Saxenian and Sabel 2008; Foley and Kerr 2013). We may also see indirect effects on market structure. New firm entry spurs competition in domestic markets, forcing incumbents to innovate and raise their productivity (Aghion et al. 2012); migrant diasporas may help shift overall patterns of trade between home and host countries (Docquier and Rapoport 2012). In theory, as we shall see, there are constraints on all these channels, and their effects are ambiguous in size, sign and significance. In practice, the available evidence often – though not always – turns up small, robust positive aggregate impacts.

The wider economic impacts of high skilled migrants are still poorly understood, and future research needs to plug a number of important gaps – not least, the distributional impacts of skilled migrants on different native workers and sectors (Collier 2013). However, the importance of these issues should already be clear to policymakers in more developed countries, who are faced with both an opportunity (more skilled migrants) and a challenge (developing policies that optimise welfare gains and minimise losses). Given their traditional focus on jobs and wages, the 'wider impacts' research agenda has potentially profound implications for migration policies in many countries.

This review is based on research originally commissioned by the UK Migration Advisory Committee (MAC), and follows the broad outlines of that brief¹. The 78 studies reviewed involve a mix of quantitative and qualitative approaches, drawing on large-scale data sets, surveys, case studies and in some cases historical analysis². The field focus is on economics, but papers are also drawn from geography, urban studies, management, entrepreneurship, innovation and trade.

The paper is structured as follows. Section 2 sets out a simple two-part framework for thinking about the impacts of high-skilled migration on the receiving country. Section 3 discusses these channels in more detail. Section 4 sets out the empirical evidence, by channel and country covered. Section 5 summarises, outlines some policy implications, and identifies areas for further research.

2. Framework

Until recently, analysis of migration's economic impacts has tended to involve static, neoclassical settings with one-off shocks and narrowly defined impacts (Kerr and Kerr 2011; Borjas and Doran 2012a). By contrast, a dynamic 'growth' setting highlights multiple wider impacts. I borrow from Chiswick (2005), Huber et al. (2010a) and Hanson (2012) to contrast the two.

First, imagine that in a open host country a set number of firms' productivity is determined by labour costs, plus fixed technological capacity and trade costs. Migrants enter solely as workers, and are perfect substitutes with natives. In this setting, skilled migration has limited economic impacts. A net migration shock will increase the labour supply, temporarily bidding down average native wages. If wages are sticky, native employment may also fall. Native outcomes should eventually readjust to pre-shock levels via international capital flows and expansion of labour-intensive sectors (Card 2005; Dustmann et al. 2008). For firms, migration helps labour productivity by cutting labour costs. But migration has no wider effects, since other productivity shifters are exogenous.

Next, consider a 'growth' setting. Here, firms can change their labour costs, innovative capacity and trading environment. Human capital helps generate new ideas, which advance the technological frontier and feed into productivity gains (Lucas 1988; Romer 1990). Firms that invest in research and development can thus build innovative capacity and raise productivity, but may face informational/financial constraints in doing so. Trade costs are now partly determined by information asymmetries and co-ordination problems, and firms that can lower these will raise productivity (and subsequently gain market share) (McCann and Acs 2011; Hanson 2012). Existing firms also face competition from entrepreneurs, who create businesses around new ideas (Schumpeter 1962; Aghion et al. 2009).

In this setting, skilled immigration – in particular – impacts both the production and consumption sides of the receiving economy. This requires relaxing some assumptions from the static framework (Huber et al. 2010a). Specifically, migrants can act as entrepreneurs and investors as well as workers; migrants have financial, social and network capital, as well as human capital; and migrants and natives be imperfect substitutes³. These channels variously feed through to determinants of firm-level performance (productivity, patenting and other measures of innovative activity), entrepreneurship and industry structure (firm entry and competition), openness (trade and FDI flows) and worker/consumer welfare (wages, employment and prices, as well as product/service mix). I consider these channels in turn, focusing on production-side impacts (consumption side effects are discussed in Nathan (2013b)). Note that in theory, the impacts of all of these 'wider impact' channels are ambiguous in terms of size, sign and significance.

3. Impact channels: theory

3.1 Innovation

Skilled migrants may influence innovation in various ways. First, the migration decision involves balancing risks and expected future returns, so may positively select highly skilled individuals, or those with sector/field expertise and experience (Borjas 1987; Malchow-Møller et al. 2011). Research-intensive fields such as science and engineering should be particularly relevant for these 'stars', who may have a disproportionate impact on knowledge creation (Stephan and Levin 2001; Zucker and Darby 2007).

Second, workforce diversity may generate externalities that contribute to knowledge creation. Specifically, diverse teams may be more effective than homogenous teams in problem-solving or generating new ideas, by leveraging a wider pool of perspectives and skills (Page 2007; Berliant and Fujita 2009). These dynamics may be particularly important in research-intensive activities (Fujita and Weber 2003).

Third, diasporic networks may contribute to knowledge diffusion. Networks reduce information and communication costs, as knowledge is exchanged through groups with high social capital; they may also aid knowledge spillovers by stimulating citations and ideas recombination through the network structure (Jaffe and Trajtenberg 2002; Kerr 2008; Docquier and Rapoport 2012).

Against this, there are reasons why migration-innovation channels may be limited. A diverse team may find it harder to communicate, and levels of trust may also be lower (Alesina and Ferrara 2005). As a result, organisations may find it harder to make decisions or allocate resources, and the quality of those decisions may be lower than in more homogenous organisations. Similarly, if knowledge flows only within diasporic communities, this will limit the scope of knowledge spillovers. Finally, diverse organisations may also face discrimination from other market actors.

Borjas and Doran (2012a, b) highlight the possibility of group-level distributional losses. If research jobs and lab space is limited, say, migrant inventors may compete with native inventors for these resources. Some 'losers' may need to shift field within a given career ('cognitive mobility') or exit into other (more or less attractive) activity. While cognitive mobility may be welfare-bad for movers in the short term, movers may gain long term⁴.

3.2 Production function

A related link from skilled migrants to productivity is via shifts in firms' production functions. If migrants and natives are imperfect substitutes, then high migration may induce both groups to shift tasks in a team or workforce setting (Peri and Sparber 2011; Lewis 2012). If firms' production functions are endogenous to labour supply shifts, then employers may react to immigration (by) substituting skilled migrants for capital investment (Lewis 2011). Migration-induced labour supply shocks then induce firms to develop more labour-intensive production techniques. This smooths any negative wage impacts of low skill migrants, but may constrain longer-term gains in firms' TFP via capital upgrading. Conversely, high-skilled labour may be complementary to capital investment – for example, skilled researchers and lab equipment – so that high-skill migration leads to an aggregate rise in receiving firms' TFP, through knowledge spillovers (as above) and/or increased task specialisation (Paserman 2008; Kangasniemi et al. 2012; Peri 2012). Again, within these aggregate effects there may be distributional 'gains' and 'losses' for specific migrant and native groups.

3.3 Trade

High net-worth migrants who enter a host economy as investors should be able to ease capital constraints for domestic firms. Such investment may trigger knowledge spillovers between investors and recipients: for example, from skilled investors with sector-specific expertise to recipient firms' (Markusen and Venables 1999; Markusen and Trofimenko 2009; Malchow-Møller et al. 2011; Giannetti et al. 2012).

Over time, migration may also alter the level and pattern of trade and foreign direct investment (FDI) flows between host and home countries. Incomplete information creates trade frictions: migrants bring improved international market knowledge, leading to better buyer-seller matching (Rauch and Trindade 2002; Rauch and Casella 2003; Peri and

Requena 2010). Diasporic/co-ethnic networks offer an effective means of contract management and enforcement (Javorcik et al. 2011). Migrants also create a 'preference channel' by demanding goods from the home country (Combes et al. 2005). The size of these trade effects will depend on the size of the diaspora and its collective human capital; skilled migrants are likely to have both better information on business opportunities, better social capital and professional networks (Kugler and Rapoport 2007; Saxenian and Sabel 2008; Docquier and Lodigiani 2010; Mundra 2012).

As with trade flows and FDI inflows, skilled migrants can also provide domestic investors with additional information on 'home' market investment opportunities (LeBlang 2011; Pandya and Leblang 2012); skilled migration may thus help reduce equity home bias (Foad 2011). Similarly, skilled migrants may provide matching and brokering functions that help multinational firms develop and manage overseas investments (Foley and Kerr 2013).

There are a number of potential constraints on these channels. First, discrimination from majority groups may limit migrant investor entry, or investment opportunities in host markets. Second, co-ethnic network effects may turn out to be trivial compared to other socio-cultural resources that skilled/well-off individuals may possess. Third, some migrants may more valuable than others - those from countries where strong trade links already exist may bring little or no additional advantage (Girma and Yu 2002).

3.4 Entrepreneurship

There is a well-established 'ethnic entrepreneurs' literature that links migrant and minority communities to self-employment, entrepreneurial activity and small business formation (Light 1984; Aldrich and Waldinger 1990; Kloosterman and Rath 2001; Baycan-Levent and Nijkamp 2009). Migrant entrepreneurship may be reactive – resulting from exclusion from mainstream economic life (Kloosterman and Rath 2001) – or proactive – for example, 'middleman minority' [sic] status may help individuals create business opportunities between social groups (Bonacich 1973). Entrepreneurs may also benefit from externalities of migrant enclaves, such as better access to information or finance (Edin et al. 2003). Skilled migrants are in a particularly strong position. Migration may positively select both highly skilled individuals – as noted above – and those with strong entrepreneurial abilities and motivation. Since they face a lower opportunity cost of investing in new skills or ways of working, skilled migrants may also be more willing to engage in disruptive business models (Duleep et al. 2012). Under globalization large, transnational diasporic groups may provide an important source of social and cultural capital (Docquier and Rapoport 2012). Highly skilled and motivated transnational entrepreneurs can set up new enterprises in a number of locations, or act as go-betweens between domestic firms and those in 'home' countries (Kloosterman and Rath 2003; Saxenian 2006; Zhou 2004; Drori et al. 2009; Honig et al. 2010).

What might hold these processes back? First, apparent effects of skilled migrant/minority status may simply collapse to individual human capital endowments, or wider structural conditions (Hunt and Gauthier-Loiselle 2010). Second, discrimination may limit opportunities for business creation and middleman-type arbitrage. Third, enclave externalities may also be limited by local group size (the smaller the group, the smaller the set of within-group matches (Zenou 2011)). Finally, diaspora/enclave

affordances may be weaker than other factors (such as class or family ties); some trans-national communities may be more organised and effective than others.

The main effect of migration-entrepreneurship channels will be on business creation. There may also be wider impacts. First, firm entry increases competition, and may stimulate incumbent firms to innovate in response (Aghion et al. 2005). Second, net firm entry itself accounts for a large share of national productivity growth, so higher levels of entrepreneurship may be short-term productivity-enhancing (Lewis 2012). Do new migrant businesses add to or displace existing firms? To the extent that (skilled) migrants identify new opportunities, the net effect is likely to be additional; however, to the extent that new opportunities are also disruptive, additionality is limited. More broadly, the *process* of firm entry may be welfare-enhancing for consumers, if entrants stimulate stronger incumbents to innovate and weaker firms to exit (Aghion et al. 2005). However, this incurs welfare losses for owners and staff in lagging domestic businesses.

3.5 Migration and cities

None of the channels above have an explicit spatial component. But skilled migrants and economic activity both tend to be unevenly distributed across physical space, especially in cities; and there are reasons to think that features of urban space may interact with production and consumption-side effects. First, cities exhibit increasing returns to economic activity via through providing ‘matching’, ‘sharing’ and ‘learning’ economies to firms and workers (Duranton and Puga 2004)⁵. These may amplify skilled migrant channels: for instance, clusters of high-value activity may improve ideas flow, both within and across sectors; and cities’ large upstream and downstream markets may help entrepreneurs develop new ideas and establish markets. Conversely, constraints on urban space may amplify *diseconomies* of cities: if the economic advantages of a given city lead to further in-migration, for example, crowding and congestion will increase, as will the cost of housing (Ottaviano and Peri 2006; Saiz 2007).

4. Empirics

What is the real-world evidence for these ‘wider impact’ channels? Additional file 1: Summary of Studies summarises the empirical literature at the time of writing. Some features of the literature are immediately apparent. First, the biggest bloc (33/78) covers the US (plus 3 for Canada). The second biggest bloc is for European countries, with Germany, the UK and Denmark the three best-covered nations. Second, while some studies explore specific impact channels, others estimate aggregate productivity effects (either on TFP or output per worker, or by inference from wages/employment). Third, some channels are better-explored than others. For example, there is a large literature on trade effects, particularly via skilled diasporic communities, and a number of studies on innovation; in contrast, entrepreneurship channels are less well covered, especially for skilled migrants. Fourth, ‘skilled migrants’ are defined in multiple, overlapping ways – most obviously through formal qualifications (degrees, PhDs) but also in terms of occupation/activity (computer scientists, inventors) or in terms of experience (foreign experts). Fifth, studies explore a range of (related) outcomes: for instance, entrepreneurship studies typically measure firm starts, but also other aspects of young firm performance

such as survival and employment, Finally, in theory wider impacts of high skilled migrants are ambiguous; in practice the bulk of empirical studies suggest small net positive effects. However, distributional impacts are much less well explored.

The rest of this section discusses the evidence base for each impact channel in turn. I begin with research exploring impacts on productivity and its influences, such as innovation, capital investment and modes of firms organisation. I then shift to studies looking at trade, entrepreneurship and other aspects of host country economic structure. Finally I look at consumption side studies, on housing markets and prices of consumer goods. In each case, I organise evidence by country blocs: North America, Europe and the rest of the world/multi-country studies. I also distinguish between the scale of analysis: individual, firm, area and country.

4.1 Innovation

The bulk of the empirical literature on skilled migrants and innovation is from the USA. A number of descriptive US studies use individual-level data to link high-skill migrants – including students – to knowledge creation. Stephan and Levin (2001), Chellaraj et al. (2008) and Wadhwa et al. (2008) highlight the contributions of Indian-American and Chinese-American scientists to US science, particularly foreign graduate students. Kerr and Lincoln (2010) use US visa policy shocks to look at the local effect of skilled migrant supply on migrant patenting (positive) and natives (close to zero). Stuen et al (2012) identify links from foreign PHD presence and subsequent highly-cited publications in science and engineering departments, but find equal effects from native PHDs. By contrast, Gaulé and Piacentini (2013) find positive effects of Chinese chemistry PHDs on departmental publishing, and that Chinese researchers make a larger contribution than Indian or Korean-origin counterparts. The authors find that the effect of the Chinese PHDs is about the same as NSF award-holders, an effect they attribute to strong positive selection. Similarly, Hunt (2011) and Hunt and Gauthier-Loiselle (2010) find that individual ‘migrant effects’ are largely explained by education and industry hiring patterns.

US area-level studies also tend to find positive links between skilled migrant presence and innovation, suggesting that urban areas may play amplifying roles. Peri (2007) finds positive associations between foreign PHD presence and state-level patenting; Hunt and Gauthier-Loiselle (2010) find evidence of spillovers from college-educated migrant presence to state-level patenting. Along similar lines, Kerr (2010b) links the presence of co-ethnic inventor groups to the spread of ‘breakthrough technologies’ in US cities. In this case, identification comes from the close correlation of ethnic inventors with skilled in-migration from the relevant sending countries (see Kerr (2010a) for more details).

Some US authors have exploited this ethnicity-migration link to explore diaspora roles in innovation more broadly (see discussion on trade below); within this field some key US case studies trace links between US-based diasporas and innovation in ‘home’ countries such as India, China, Taiwan, Ireland and Israel (Kapur and McHale 2005; Saxenian 2006; Saxenian and Sabel 2008). Kerr (2008) identifies links between US-based co-ethnic communities and industrial performance in home countries; however, Agrawal et al. (2008) find that physical location is up to four times more important for knowledge diffusion than co-ethnic connections.

A few very recent studies use cognitive space to explore skilled migrant-native distributional impacts. Results vary widely, probably in part because of time and field choices (Kerr 2013). Borjas and Doran (2012a) examine how the arrival of mathematicians from the former Soviet Union affected the publications and career trajectories of their US counterparts, finding little evidence of aggregate increases in knowledge but strong evidence of native crowding out, both in terms of subject shifts and exits from the field⁶. Moser et al. (2012) examine the effect of Jewish chemists exiled from Nazi Germany on patenting in US chemistry. They uncover evidence of substantial crowding-in, with émigré presence leading to a 30% increase in US native patenting between 1920 and 1970. Using data from 1999-2008, Gaulé and Piacentini (2013) also find evidence of spillovers from Chinese chemistry PhDs to the productivity of their supervisors.

Innovation-related research in European countries tends to focus on firm-level analysis. A relevant exception is Nathan (2012b), who looks at minority ethnic inventors in the UK. Using panel data, he finds that the diversity of inventor communities helps raise the level of individual patenting activity, and suggestive evidence that high-patenting minority ethnic inventors, particularly East Asian ‘stars,’ drive up overall patenting rates.

A few firm-level studies have uncovered positive links from skilled migrants to innovation. Using Danish cross-sectional data, Ostergaard et al. (2011) finds no significant association between migrant presence and innovation outcomes, but that firms who look to hire foreign employees are more likely to innovate. In practice, causality could run both ways here. Ozgen et al. (2013) use Dutch employer-employee information to try and untangle this. They find that workforce migrant presence has no significant link to innovation, but that more diverse foreign workforces make innovation more likely. Similarly, Parrotta et al. (2014b) find positive connections from migrant diversity to innovation using Danish data.

These results raise the question of how migrant-innovation channels operate inside the firm. Some clues come from Nathan and Lee (2013), who look at ‘top team’ diversity in London firms. They find that companies with ethnically diverse senior management are more likely to introduce new product innovations. Top team diversity also influences sales orientation, and is particularly important for reaching international markets and serving London’s cosmopolitan population. Nathan (2013a) extends the analysis across England and Wales, finding positive links between top team ethnic diversity and process innovation.

As in the US, European area-level studies typically find positive effects of skilled migrant presence and innovation outcomes. Niebuhr (2010) finds that the diversity of migrants is linked to higher R&D spend in German regions, although this result is only cross-sectional. Echoing US studies, Scellato et al. (2012) find strong associations between the presence of internationally mobile researchers and the quality and scope of networks across the US and Europe. Using panel data and instruments, Ozgen et al. (2012) uncover positive links from skilled migrant presence to area-level patenting across EU regions. Using a similar identification strategy, Gagliardi (2011) finds similar results on levels of product and process innovations. Most recently, Bosetti et al. (2012) find positive effects of skilled migrant presence on patenting and researcher citations in a panel of 20 European countries.

Innovation studies in the rest of the world are very sparse. Maré et al. (2013) use firm and area-level data for New Zealand: they find positive associations from area-level

migrant presence to innovation, but no significant links at firm level. They speculate that migrants might help drive up other innovation inputs such as R&D spend, but are unable to uncover these connections.

4.2 Production function

The few studies to directly explore responses to skilled migrants within the firm are from the US. Foley and Kerr (2013) suggest that skilled migrants working in multinationals help those firms expand and co-ordinate investment activity in their native countries. Using data for 645 US MNEs in 45 countries, they show that increases in 'ethnic patenting' are linked to rising shares of affiliate activity in the relevant sending countries, helping those firms become more competitive. A related study by Lewis (2011) looks at capital spending decisions in US manufacturing plants between 1988-1993, finding that employers in areas of high migration substitute capital investment for low-skilled migrants. By contrast, middle-skilled migrants act as complements to new equipment, implying some kind of productivity gains.

Peri and colleagues (Peri and Sparber 2011; Peri 2012; Peri et al. 2013) have conducted a number of studies at US city and state level. Peri (2012) finds a strong positive association between immigration and state-level TFP, and explains one third to one half of this link to increased task specialisation by native workers. Working with a panel of US cities, Peri et al. (2013) show that an increase in immigrant scientists and engineers leads to increased wages for US college-educated workers (inside and outside STEM sectors), which they interpret as the result of migrant-led productivity shifts. They also find that changes in task specialisation play a key role. By contrast Quispe-Agnoli and Zavodny (2002) find negative significant effects of migrants for US high-skilled manufacturing industries, an effect they ascribe to slow assimilation of new arrivals. These studies are an important advance on the classic work by Ottaviano and Peri (2006), which links migrant diversity to higher productivity in US metros. Ottaviano and Peri argue that effects are largely driven by agglomeration economies, and ascribe some of this to skilled migrants, but are unable to test this directly.

More recent firm-level analyses uncover more nuanced findings. Kerr et al. (2013) look at skilled migrants and employment structures in US firms, using policy shocks to instrument to simultaneity concerns. They find that increased shares of skilled migrant employment are linked to higher overall employment, although they also uncover interesting distributional impacts on native workers; young natives' employment prospects are higher than for older US-born workers, and older worker exits are highest in STEM occupations. Bound et al. (2013) explore related concerns in the US computer science industry between 1994-2004. Using a calibrated model, they find that skilled migrants reduced native workers' wages and employment, but helped raise overall employment in the sector as well as raising demand for complementary inputs (such as retail installation and repair activities).

European evidence is more clear-cut. Hoogendoorn and Van Praag (2012) use a randomised control trial on Dutch students to show a positive effect of migrant diversity on team performance (when over 50% of the team are foreign-born). Parrotta et al. (2014a) and Trax et al. (2012) both identify causal effects for firm level data, using instruments and GMM estimation respectively. The former find that ethnic diversity helps raise TFP in Danish firms operating in trade-intensive sectors, suggesting that

diaspora externalities may explain the link. The latter find strong spillover effects from workforce diversity (measured by nationality) to German firm-level productivity. They also find spillovers from diverse firms to other firms in the area, raising area-level productivity. Brunow and Blien (2011), also working with German data, find negative links from skilled migrants to firms' employment; they interpret this as evidence of productivity gains (leaner production functions).

Suedekum et al. (2012) conduct an area-level analysis using German panel data: they find a positive link from high-skilled migrant employment to area-level native wages and employment, which is increasing in skilled migrant diversity. Since they find no comparable links for low-skilled migrants, they suggest that high-skilled arrivals are helping raise productivity. For the UK Nathan (2011) finds weak positive links between migration and urban-level productivity, as proxied by skilled wage changes.

At country level Kangasniemi et al. (2012) compare labour productivity growth in Spain and the UK, using growth accounting techniques and GMM. Growth accounting results suggest that migration has made a negative contribution to labour productivity in Spain and a 'negligible' contribution in the UK, with the difference explained by the UK's higher share of skilled migrants. GMM estimates suggest a positive long-term effect of migrants on TFP in the UK and a negative effect in Spain, explained by human capital differences and more successful assimilation policies in the UK.

Again, there are very few studies in the rest of the world⁷. Paserman (2008) looks at Israeli manufacturing firms in the 1990s, a period of high immigration from the former Soviet Union. He finds negative associations between immigrant share and productivity in low-tech sectors, but positive links for high-technology industries suggestive of production complementarities. For New Zealand, Maré and Fabling (2011) find positive links between local area migrant share and productivity in firms, but do not establish a causal relationship.

4.3 Trade

There is now a substantial empirical literature on skilled migrants, investment and trade (see Docquier and Rapoport (2012) for a recent review). The bulk of these studies are international cross-country analyses, which I discuss here alongside more micro evidence.

Nielsen (2010) looks at demographic diversity in founding teams for US technology start-ups: he finds a positive correlation between diversity and subsequent foreign market entry, but this is not significant. Leblang (2011) and Pandya and Leblang (2012) focus on venture capital investments, showing significant associations between diaspora network presence and the level of VC flows from US investors. They suggest these results derive both from US-based skilled migrants, and from diaspora members advising US VC firms about opportunities in sending countries. Similarly Foad (2011) looks at equity holdings data for 28 countries between 1997 and 2004, finding that skilled migration helps increase foreign equity holdings and reduces home bias via reducing risk and improving matching.

Other US studies look at skilled diasporas' role in FDI and/or trade flows. Kugler and Rapoport (2007) show that skilled diasporic groups are especially important in predicting future FDI inflows; Javorcik et al. (2011) also show strong network externalities from large skilled diasporas on FDI inflows to sending countries. Mundra (2012) focuses on

immigrant occupational structure, finding that higher shares of migrants in professional occupations significantly increases trade flows between the US and trading partner countries.

As in the US, the bulk of European trade studies use cross-country data. An exception is Malchow-Møller et al (2011) which finds that Danish firms that hired foreign experts became more productive and increased their exports of goods and services. At national level, a number of European studies find significant positive links between migrants and FDI/trade flows, although none specifically look at skilled migrant effects⁸. Two of these are worth highlighting here. Girma and Yu (2002) compare trade effects of migration to the UK from Commonwealth and non-Commonwealth countries. They find that non-Commonwealth migration has a significant export-enhancing effect in the UK, but there is no effect from Commonwealth country migrants. They suggest that this is because non-Commonwealth migrants bring new information to UK economic actors, reducing the costs of trade, whereas UK-Commonwealth trade patterns are already well established. Peri and Requena (2010) focus on trade for Spanish provinces, 1995-2008, finding that immigration significantly raises trade – particularly for differentiated goods and for countries culturally distant from Spain.

Outside Europe and the US, Markusen and Trofimenko (2009) use plant-level data from Colombia to show significant learning externalities from foreign trainers to local workers, which raise native wages and value-added. Similarly, Giannetti et al (2012) look at firms in China who hire directors with foreign experience (returning migrants). They show that firms with such directors have higher valuation, productivity and profitability; better corporate governance, and higher levels of international market activity.

Building on the seminal paper by Rauch and Trindade (2002), a number of international studies show positive effects of skilled migrants on trade and FDI flows, especially for differentiated goods. For example, Docquier and Lodigiani (2010) also show strong network externalities from large skilled diasporas on FDI inflows to sending countries. Egger et al. (2012) use a quasi-experimental approach for 100 countries between 1991 and 2000, showing that highly concentrated skilled (or unskilled) migrants induce higher trade flows – particularly for differentiated goods. Using Canadian data, Bo and Jacks (2012) take a different angle and look at links between immigration and import varieties. They find strong links between the two, although they are unable to directly test for the role of skilled migrants.

4.4 Entrepreneurship

The current evidence is mainly from the US, and highlights the importance of large and skilled diasporic communities in influencing firm formation in host countries.

A number of descriptive studies set the US scene. Saxenian (2002) finds that that skilled migrants make up 1/3 of the Bay Area's engineers, with two-thirds born in Asia and three quarters of these from China and India. In 1998, Chinese and Indian engineers were senior executives at one quarter of Silicon Valley's technology businesses; these immigrant-run companies collectively accounted for more than \$26.8 billion in sales and 58,282 jobs. Anderson and Platzer (2007) find that migrants have started 25% of US VC-backed public companies, and 40% of VC-backed technology firms. Wadhwa et al (2008) find that immigrant firm founders tend to have both advanced STEM education and 'high rates of entrepreneurship and innovation' – although the same is also true of US-born founders. Working with a sample of 1300 'high-impact' technology firms and

2000 founders across the US, Hart and Acs (2011) find around 16% of firms have at least one immigrant founder; over three quarters of these are now US citizens.

A smaller number of papers try to identify a 'skilled migrant' effect on entrepreneurial outcomes. Hunt (2011, 2013) performs a number of individual-level analyses on skilled migrants. Looking at the 2003 US National College Survey, she finds that immigrants are more likely to start companies than similar natives, and those who entered on a student/trainee or a temporary work visa have a large advantage over natives in wages, patenting, and publishing. Immigrants' higher education and field of study explain much of this. Analysis of the 2009 and 2010 American Community Surveys suggests that 'immigrants from the highest income countries are the best and brightest workers (2013, p1).' Similarly, Kahn et al. (2013) use survey data on US scientists, finding that immigrants are more likely to become 'science entrepreneurs' even after controlling for preferences, education, study field, demographics and time effects.

A few studies attempt to explore spillover effects of immigrant entrepreneurs on their firms and the wider economy. Hart and Acs (2011) perform ANOVA on their 'high-impact' firms sample, but find similar levels of economic and technological performance between firms with migrant founders and those without. Duleep et al. (2012) provide stronger evidence using calibration exercises, finding positive links from skilled migrants to job creation, business entry and immigration across US sectors and the US workforce.

There is a large European tradition of descriptive research on 'ethnic entrepreneurship,' which sometimes involves studies of specific migrant communities⁹. Studies of skilled migrant entrepreneurs are much rarer, and results are less clear-cut. Guerra and Patuelli (2011) find significant spatial network externalities between migrant entrepreneurs in Swiss municipalities, and some urban-rural differences. For Denmark, Marino et al (2012) find that workforce ethnic diversity leads to entrepreneurship in financial and business services. Levie (2007) uses data from the GEM survey to look at individual-level determinants of entrepreneurship in the UK. OLS regressions show migrant status increases the odds of entrepreneurial activity, but that minority ethnic status only has a marginal effect. Working with a repeat cross-section of London firms, Nathan and Lee (2013) find suggestive evidence linking migrant status to proactive entrepreneurship. Fairlie et al. (2012) compare economic outcomes for skilled Indian-origin communities in latter-day UK, Canada and the US, using OLS regressions on Census data. They find that Indian entrepreneurs in the US have above-average business incomes; around 50% of the difference is explained by education, and around 10% by differences in industry choice. By contrast, Indian-origin entrepreneurs in the UK and Canada are less well educated, have lower than average incomes but are more likely to hire employees.

The review turns up only one relevant study from outside the US/Europe. Schuetze and Antecol (2007) use a Borjas-type model to look at self-employment among new migrants in Australia and Canada. They find self-employment rates for a given cohort typically catch natives within 10-20 years of arrival. Institutional and market structure factors are the most substantial determinants, although policy differences play a role at the margin.

5. Conclusion

Skilled migrants are becoming an increasingly important element in global migration flows, especially to more developed nations. Policymakers and researchers show growing

interest in the economic opportunities and challenges presented by these groups. This paper surveys the rapidly growing body of research on the economic impacts of high-skilled migrants beyond the labour market.

Locating migrant impact channels within endogenous growth frameworks highlights a range of potential production side effects (on productivity and its drivers, as well as trade flows, entrepreneurship and market structure) and impacts on the consumption side (notably on prices and product/service mix, especially non-tradeables). In theory, these wider impacts are ambiguous in size, sign and significance: we can identify constraints on each channel, and effects may vary over time. In practice, much of the evidence turns up small, robust positive impacts. Distributional channels are less well established in the literature, but it is clear that aggregate effects can hide gains and losses for native workers and firms (or for other migrants). Migration flows to developed countries are spatially uneven, with cities and urban areas typically experiencing the largest inflows. There are reasons to think that urban location may also amplify or constrain skilled migrant impact channels, through a combination of demographics and features of the urban economy.

The largest body of host country impacts work is for the USA. Descriptive studies suggest that skilled migrants, especially those of South/East Asian origin, make significant contributions to the science and technology fields, both through innovative activity and entrepreneurship. A number of firm and area-level studies also identify skilled migrant impacts on productivity, with positive selection and co-ethnic groups operating as key channels. A few studies also identify important distributional effects in innovation and other productivity drivers, which appear to vary by sector, technology field and period.

The empirical literature in European countries and the rest of the world is sparser. Results are also more mixed, reflecting the much greater heterogeneity in migrant levels and flows; sending countries and communities; and receiving country history and institutions. All of this makes generalisations difficult: but within the EU, at least, studies typically find small net positive effects of high skilled migrants on innovation and productivity, particularly through workforce diversity and in high-tech and/or export-intensive sectors, and on trade flows through skilled diasporic groups. The pattern of results for entrepreneurship is harder to establish, as there are far fewer studies of skilled migrant communities. However, the larger qualitative and case study literature provides suggestive evidence of the importance of migrant entrepreneurship in a number of European countries.

5.1 Policy implications

This body of research has important implications for public policy, especially given the substantial real-world increases in skilled migrants to more developed countries. It is still hard to make precise prescriptions: instead, I set out some general pointers. The most obvious takeaways from the literature are the importance of pro-skills migration policy, and the need to develop programmes to actively select stars and those with high entrepreneurial potential. The literature also suggests positive affordances of skilled diasporas and cultural diversity in the skilled workforce more generally, although it is not obvious how to target these directly. It is also unclear which diasporic groups

receiving countries should encourage – this may vary from case to case. Encouraging skilled migrants into urban environments may pay dividends because of the economic affordances of cities; conversely, very large inflows may lead to (short term) increases in the cost of living (Peri et al. 2013). Finally, the research also implies policymakers should be careful to avoid adverse distributional impacts on native workers or firms – although this strand of the literature is still very under-developed, and more work is needed before firm conclusions can be drawn.

What does this imply for real-world migration regimes? Australia, Canada and New Zealand – among others – have operated skill-biased migration regimes for many years; the UK has recently introduced a points based system but combined with this with caps on non-EEA migrants. Two key entry points are through the HE system and as entrepreneurs. Given the evident contributions of migrant researchers to academic productivity, restrictions on post-study stays and activity – as the UK has recently introduced – would seem counterproductive; encouraging international collaborations and networked research communities would seem promising. Startup visa programmes are still very rare. Given the difficulty of identifying the most promising candidates, there is a good case for involving domestic investors and industry experts in selection; this is the model that Canada and Chile – but not the UK – have chosen to follow.

The inherent uncertainties in trying to ‘push’ dynamic, long term impacts of skilled migrants have much in common with another essentially experimental policy field, that of industrial policy. Rodrik (2004) highlights the need for clear rules and governance in industrial strategies, especially when trying to promote innovation and entrepreneurship; policymakers also need to embrace small-scale experimentation, but be ready to rapidly drop programmes that are not working and scale up initiatives where clear effects can be seen. Given its political sensitivity across the OECD, implementing such an approach for immigration policy will be very challenging.

5.2 Areas for future research

The wider impacts literature is important but under-developed. As Kerr (2013) notes, there are substantial knowledge gaps even in the US, the best-covered country in this review. The research base is very sparse for other countries; this matters because sector, country and area-specific differences appear to be highly important in shaping skilled migrants’ economic impacts. The first priority for future research is simply more research.

A second area for further work is analysis at different scales. For example, only a few studies look at the role cities may play. Analysis inside the firm is also crucial – both to examine the mechanics of employer behaviour in detail, and to clarify channels in different parts of organisational space: we have suggestive evidence of distinct links in senior management and the wider workforce, for example, but more research is needed to ground these.

Third, the distributional impacts of skilled migrants on native workers, firms and markets need to be better theorised and empirically addressed. The few studies that exist show rather different outcomes, suggesting that technological/industrial context may play crucial mediating roles, but as yet we have very little robust knowledge.

Fourth, and related to this, the *quality* aspect of skilled migrant channels (for instance, the value of inventions or the additionality of migrant businesses) is more or less

untouched research space. Some studies have looked descriptively at the quality of patents via citations analysis, or the presence of migrant scientists in scientific halls of fame, but broader measures of societal value have not yet been properly explored.

Fifth, and as discussed in Nathan (2013b), the consumption-side effects of skilled migrants need further analysis. Skilled migration may affect (local) prices, product/service mix, and public service usage. In practice, skilled migrants, being a small proportion of the overall migrant population, are unlikely to have substantial *direct* effects. However, a skilled migrant channel may operate on through the interaction of production side comparative advantage and new (migrant-driven) sources of consumer demand. Very large inflows of skilled migrants may also have visible effects: one recent US working paper also connects the arrival of migrant STEM workers to higher house prices for skilled natives (Peri et al. 2013).

Addressing these knowledge gaps will not only improve researchers' understanding of the wider economic impacts of migration, it will also help policymakers design better-grounded immigration policy. Conversely, immigration policy design itself is also an under-used basis for identifying effects. A number of American studies productively use aspects of the immigration regime for skilled migrants (such as H1B quotas and lotteries) to identify causal impacts of skilled migration, but policy-based evaluations are far less common in other countries. If policymakers across the OECD move towards the experimental paradigm suggested above, researchers will also be better able to identify the wider economic impacts of skilled migrants.

Endnotes

¹I do not consider the impacts of immigration on sending countries. Agrawal et al (2011) and Docquier and Rapoport (2012) provide useful overviews.

²In the jargon this was a 'rapid review' rather than a formal meta-analysis. Searches were conducted from existing review documents, through Google Scholar, through websites of key research institutes (CEPR, IZA, NBER) and relevant UK government departments, and through the research team's professional networks. Returned studies were screened on relevance (dealing with high skilled migrants or closely related groups / issues) and ranked on quality (identification strategy, with the top-ranked studies able to report causal effects). Additional file 1 details empirical studies that passed both screening processes. Other relevant contextual material is also referred to in the main text.

³There is strong empirical evidence for the last of these, particularly for skilled migrants. See e.g. Manacorda et al. (2012) for the UK or for the US, Peri and Sparber (2011).

⁴In the case of Borjas and Doran's study, for example, many of the native exits leave academia to work in jobs which may pay substantially better (such as working as 'quants' in financial services firms).

⁵For a non-technical discussion of the economics of cities see Glaeser (2011) or Cheshire et al. (2014).

⁶Thanks to Kirk Doran for clarifying this point (personal communication, 22 October 2013).

⁷Two related macro studies are worth mentioning. Llull (2008) conducts a macro analysis on 24 countries between 1960 and 2005. He finds a negative significant effect of immigration on productivity; with an offsetting positive effect on employment. However

Ortega and Peri (2012) use a panel of 147 countries to show that openness to immigration increases long-run income per head, with the main effect operating through a rise in receiving country TFP.

⁸Parsons (2005) projects the impact of A8 migration on EU-15 trade flows, suggesting that accession will increase imports from accession countries by 1.4% and exports by 1.5%. De Simone and Manchin (2012) find some evidence of diaspora externalities, with a significant correlation between migrant stocks and trade activities in respective sending countries.

⁹In the UK, for example, important contributions include Altinay and Altinay (2008), Basu (1998, 1999, 2002, 2004), Basu and Goswami (1999), Clark and Drinkwater (2000, 2010), Crick and Chaudhry (2010), Godley (2001), Jamal (2005), McEvoy and Hafeez (2009), Ruef et al. (2003) and Wang and Altinay (2012).

Additional file

Additional file 1: Summary of studies referred to in the text.

Abbreviations

EU: European Union; FDI: Foreign direct investment; GMM: General method of moments; OECD: Organisation of economic co-operation and development; OLS: Ordinary least squares; STEM: Science, technology, engineering and mathematics; TFP: Total factor productivity; UK: United Kingdom; USA: United States of America; VC: Venture capital.

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